

WHAT IS CLAIMED IS:

1. A method of manufacturing a lightweight solidifying material of changing a fluid raw material containing a water content and a solid content to a lightweight solidifying material while carrying the fluid raw material to a destination place, by using a pipe-type mixer which is provided with a mixing pipe passage, a shaft member coaxially pivoted within the mixing pipe passage, a screw vane and an agitating blade arranged in parallel in the order from an upstream side on the outer surface of the shaft member, a rotation driving means of the shaft member, and at least one additive material supplying port arranged in a corresponding position to the agitating blade in the shaft member, and is structured such as to carry the fluid material supplied into the mixing pipe passage to the additive material supplying port via the rotated screw vane, thereafter supply an additive material to the fluid material from the additive material supplying port, and agitate and mix the fluid material and the additive material by the rotated agitating blade, comprising:

(A) a step of adjusting a gravity of the fluid raw material by adding or removing a water content;

(B) a step of continuously carrying the gravity adjusted fluid raw material via a carrier passage constituted by a pipe passage in which at least one the pipe-type mixer is interposed;

(B1) a solidifying material adding step of adding and mixing a solidifying material as an additive material to the fluid raw material under the carrying step by the pipe-type mixer interposed in the middle of the carrier passage; and

(B2) a lightweight material adding step of adding and mixing a lightening material as an additive material to the fluid raw material obtained by adding the solidifying material by another pipe-type mixer interposed in a downstream side of the pipe-type mixer in the solidifying material adding step; or supplying the lightening material from another additive material supply port of the pipe-type mixer in the solidifying material adding step and adding and mixing the lightening material to the fluid raw material obtained by adding the solidifying material.

2. A method of manufacturing a lightweight solidifying material as claimed in claim 1, wherein a pressure pump is interposed in an upstream side of the pipe-type mixer adding the solidifying material in the carriage passage, and each of the additive materials is added and mixed while passing the gravity adjusted fluid raw material through the pipe-type mixer by utilizing a pressure of the pressure pump.

3. An apparatus for manufacturing a lightweight solidifying material for changing a fluid raw material containing a water content and a solid content to a lightweight solidifying material while carrying the fluid raw material to a destination place, by using a pipe-type mixer which is provided with a mixing pipe passage, a shaft member coaxially pivoted within the mixing pipe passage, a screw vane and an agitating blade arranged in parallel in the order from an upstream side on the outer surface of the shaft member, a rotation driving means of the shaft member, and at least one additive material supplying port arranged in a corresponding position to the agitating blade in the shaft member, and is structured

such as to carry the fluid material supplied into the mixing pipe passage to the additive material supplying port via the rotated screw vane, thereafter supply an additive material to the fluid material from the additive material supplying port, and agitate and mix the fluid material and the additive material by the rotated agitating blade, comprising:

(a) a means for adjusting a gravity of the fluid raw material by adding or removing a water content;

(b) a structure for continuously carrying the gravity adjusted fluid raw material via a carrier passage constituted by a pipe passage in which at least one the pipe-type mixer is interposed;

(b1) a structure for adding and mixing a solidifying material as an additive material to the fluid raw material under the carrying step by the pipe-type mixer interposed in the middle of the carrier passage; and

(b2) a structure for adding and mixing a lightening material as an additive material to the fluid raw material obtained by adding the solidifying material by another pipe-type mixer interposed in a downstream side of the pipe-type mixer in the solidifying material adding step; or supplying the lightening material from another additive material supply port of the pipe-type mixer in the solidifying material adding step and adding and mixing the lightening material to the fluid raw material obtained by adding the solidifying material.

4. A pipe-type mixer apparatus comprising:

a mixing pipe passage having an upstream side supply portion to which a first fluid material is pressure supplied and a downstream

side discharge portion from which a mixed material is discharged;

a shaft member coaxially pivoted within the mixing pipe passage;

a screw vane and an agitating blade arranged in parallel in the order from an upstream side on the outer surface of the shaft member;

a rotation driving means of the shaft member; and

a second fluid material supplying port arranged in a corresponding position to the agitating blade in the shaft member,

wherein the pipe-type mixer is structured such as to rectify the first fluid material supplied into the mixing pipe passage by the rotated screw vane, thereafter supply the second fluid material to the first fluid material from the supplying port in the shaft member, agitate and mix the first fluid material and the second fluid material by the rotated agitating blade, and discharge the agitated and mixed material via the discharge portion.

5. A pipe-type mixer apparatus as claimed in claim 4, wherein a rectifying capacity per unit time achieved by the screw vane is equal to or more than a supply amount of the first fluid material per unit time.

6. A pipe-type mixer apparatus as claimed in claim 4, further comprising:

a mixing pipe passage having an upstream side supply portion to which a first fluid material is supplied in a non-pressurized state and a downstream side discharge portion from which a mixed material is discharged;

a shaft member coaxially pivoted within the mixing pipe

passage;

a screw vane and an agitating blade arranged in parallel in the order from an upstream side on the outer surface of the shaft member;

a rotation driving means of the shaft member; and

a second fluid material supplying port arranged in a corresponding position to the agitating blade in the shaft member,

wherein the screw vane carries and discharges the first fluid material supplied within the mixing pipe passage on the basis of an extruding effect, and

wherein an extrusion amount per unit time achieved by the screw vane is equal to or more than a supply amount of the first fluid material per unit time.

7. A pipe-type mixer apparatus as claimed in any one of claims 4 to 6, wherein a supply port of the first fluid material is provided in a corresponding position to the upstream side supply portion in the shaft member.

8. A pipe-type mixer apparatus as claimed in claim 6, wherein a hopper is connected to the upstream side supply portion of the mixing pipe passage, and the first fluid material reserved within the hopper is taken out by a quantitative feeder so as to be supplied to the upstream side supply portion.

9. A pipe-type mixer apparatus as claimed in any one of claims 4 to 8, wherein the mixing pipe passage is structured such that a part or all of the downstream side of the agitating blade is positioned in an upper side of the corresponding portion to the screw vane and the agitating blade, whereby the first fluid material,

the second fluid material and the mixed material are always filled at least in the downstream side portion of the screw vane.

10. A pipe-type mixer apparatus as claimed in claim 4, wherein a boost screw vane promoting the delivery of the mixed material to the downstream side discharge portion is provided in a downstream side of the agitating blade in the shaft member.

11. A pipe-type mixer apparatus as claimed in any one of claims 4 to 10, wherein a cover member is provided in a front side of the second fluid material supply port in the shaft member in a rotating direction of the shaft member, the cover member rotates together with the shaft member and the agitated material is pushed away, whereby a supply space for the second fluid material is formed in a second fluid material supply port position.

12. A pipe-type mixer apparatus as claimed in any one of claims 4 to 11, wherein the agitating blade includes a double function blade having an agitating operation and a mixed subject carrying operation, and a single function blade having only the agitating operation, and the double function blade and the single function blade are arranged along a spiral direction around the shaft member in accordance with an alternate arrangement such that one single function blade is interposed every one or two double function blade.

13. A pipe-type mixer apparatus as claimed in any one of claims 4 to 12, wherein the agitating blade is formed in an elongated flat shape, and a plurality of the agitating blades are arranged along a spiral direction around the shaft member at a phase interval of 90 degree or 60 degree.

14. A pipe-type mixer apparatus as claimed in any one of claims

4 to 13, wherein the screw vane is formed such that a winding number is between 1 and 3, and a pitch is 0.4 to 0.8 times of a diameter of the mixing pipe,

wherein the agitating blade is arranged in 5 to 15 pitches at an interval between 4 and 6 sheets per 1 pitch, along a spiral direction around the shaft member,

wherein a rotational speed of the shaft member is between 150 and  $200/\pi d$  (rpm) at a time of driving the apparatus, in which a diameter of the screw vane and the agitating blade is set to  $d$ , and

wherein a material flow speed  $v$  within the mixing pipe passage at a time of driving the apparatus is between 10 and 50 m/min.

15. A solidifying material supplying apparatus for mixing a powder granular material and a liquid so as to produce a solidifying material, and supplying the solidifying material to an external portion, comprising:

a means for dropping and supplying the powder granular material;

a means for supplying the liquid in a cascade to the dropping powder granular material in such a manner as to pinch or narrow down the powder granular material from the periphery of the powder granular material, and combining the powder granular material with the liquid; and

an agitating and mixing means for agitating and mixing the combined powder granular material and the liquid.

16. A solidifying material supplying apparatus for mixing a powder granular material and a liquid so as to produce a solidifying

material, and supplying the solidifying material to an external portion, comprising:

- a means for dropping and supplying the powder granular material;

- a means for swirling and dropping the liquid and dropping the powder granular material to the swirling portion, and combining the powder granular material with the liquid; and

- an agitating and mixing means for agitating and mixing the combined powder granular material and the liquid.

17. A gravity adjusting apparatus comprising:

- a gravity adjusting tank to which a fluid material including a moisture content and a solid content is input;

- a volume measuring means for measuring a volume of the fluid material within the gravity adjusting tank;

- a weight measuring means for measuring a weight of the fluid material within the gravity adjusting tank;

- a gravity measuring means for determining a gravity on the basis of results of the volume measuring means and the weight measuring means;

- a water adding means for adding water into the gravity adjusting tank in correspondence to the measurement results of the gravity measuring means, in such a manner that the fluid material within the gravity adjusting tank has a predetermined gravity; and

- a water discharging means for discharging water from the gravity adjusting tank in correspondence to the measurement results of the gravity measuring means, in such a manner that the fluid

material within the gravity adjusting tank has a predetermined gravity.

18. A gravity adjusting apparatus as claimed in claim 17, wherein the water discharging means is structured such as to suck and discharge a clear supernatant water of the fluid material reserved within the gravity adjusting tank.

19. A gravity adjusting apparatus as claimed in claim 17 or 18, wherein the water discharging means is structured such as to suck and discharge the water content of the fluid material reserved within the gravity adjusting tank via a filter medium.

20. A gravity adjusting apparatus as claimed in any one of claims 17 to 19, wherein the gravity adjusting apparatus is provided with an agitating and mixing means for agitating and mixing the gravity adjusted fluid material, and a delivering means for delivering the agitated and mixed fluid material to an external portion.